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A Fiberscopic Technique for the Study of Velopharyngeal Closures (First Report)

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Velopharyngeal closures were observed using a nasopharyngeal fiberscope and were recorded by a 16 mm cine camera.

The resting forms of the horizontal sections of velopharyngeal cavities were grouped into three types: the "oblate elliptical type", "prolate elliptical type" and "intermediate type".

The manner and finished forms of closure were grouped into three types: the "soft palate type", "lateral wall type" and "mixed type". According to the definition, 11 out of the 45 subjects studied showed the "soft palate type", eight showed the "lateral wall type" and the rest were classified as the "mixed type". There seemed to be some correlations between the closure forms and resting forms.

Our method is thought to have two advantages with respect to the observation of various activities and halation-free observations.

(Key Words: Velopharyngeal Clossure, Nasopharyngeal Fiberscopy)

INTRODUCTION

Velopharyngeal closures were observed and recorded by a nasopharyngeal fiberscope and a 16 mm cine camera.

MATERIALS AND METHODS

Forty-five healthy adult subjects, 37 males and eight females, were studied. Non of them had any speech disorders or nasopharyngeal disease.

According to the speech sample recorded by a taperecorder, subjects were ordered to utter /a/ /a/ /a/, /i/ /i/ /i/, /pa/ /pa/ /pa/, /pi/ /pi/ /pi/, /sha/ /sha/ /sha/, /shi/ /shi/ /shi/ (Japanese vowels and consonants), to sing /a:/ /a:/ /a:/ and to hum /m:/ /m:/ /m:/ in "C", "G" and the high "C" octave on the musical scale and to blow. Then, the gag reflex was achieved by stimulation with a tongue depressor. During the examination, velopharyngeal closure was observed pernasally by a side-viewing nasopharyngeal fiberscope (NPF – S_4, Olympus Co., Japan). After the examination, the fiberscope was inserted into the oral cavity and retrograde observations of velopharyngeal movement were carried out. A 500 W cold light

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supply (CLX — F, Olympus Co., Japan), a 16mm cine camera (Beaulieu R 16, France) and 16mm cine films (Fuji RT 500, Fuji Film Co., Japan) were used in this study. Developed films were analysed by a motion analyzer (NAC motion analyzer, Japan).

RESULTS

1. The nasopharyngeal fiber scope had a small-caliber distal end (3.4mm in outer diameter), a short bending section and a clear circular visual field with a visual angle of 52°. Insertion was very easy and the observation of velopharyngeal movement was performed without any difficulty.

OBSERVATIONS FROM THE NASAL CAVITY

2. The fiberscope was inserted into the nasal cavity. The tip was placed in a position where the epiglottis could be observed vaguely. At rest, the horizontal section of the velopharyngeal cavity seemed elliptical in shape, although wide variations were observed between the forms in each individual. The forms were grouped into three types: the "oblate elliptical type", "prolate elliptical type" and "intermediate type" as shown in Fig. 1.

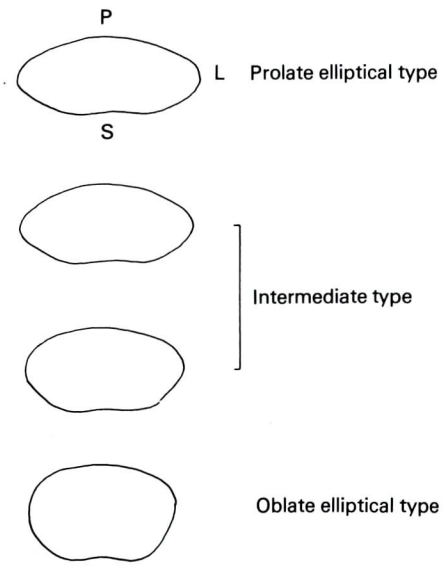

Fig. 1 Resting forms of a horizontal section of the velopharyngeal cavities
The forms were grouped into three types; "prolate elliptical type", "oblate elliptical type" and "intermediate type".
(P: posterior wall, L: lateral wall, S: soft palate)

3. Velopharyngeal closure was chiefly obtained by movement of the soft palate and pharyngeal lateral wall, and in some subjects, it was accompanied by posterior wall movement. In the same subject, almost the some movement was observed in uttering vowels and consonants, in blowing or in gagging, although the velocity and strength of the closure were not the same

in each movement. However, the closure forms in each subject were different. The closure forms were grouped into three types and were provisionally named the "soft palate type", lateral wall type" and "mixed type". The velopharyngeal closure of the "soft palate type" was predominantly obtained by elevating movement of the soft palate, while closure of the "lateral wall type" was obtained both by the approaching movement of lateral walls and by the elevating movement of the soft palate (See Figs. 2, 3 and 4).

According to our definition, 11 out of the 45 subjects showed the "soft palate type", eight showed the "lateral wall type" and the rest were classified as the "mixed type". Movement of the posterior wall was observed in two subjects.

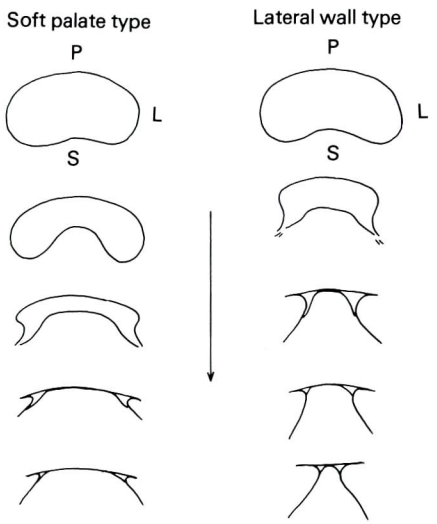

Fig. 4 Schema of velopharyngeal closure
The manner and finished forms of closure were grouped into three types: "soft palate type", "lateral wall type" and "mixed type".
(P: posterior wall, L: lateral wall, S: soft palate)

OBSERVATIONS FROM THE ORAL CAVITY

4. In some subjects who showed a weak gagging reflex, velopharyngeal closure in uttering /a/ or in the gagging reflex was observed retrogradely from the oral cavity. The approaching movement of the soft palate and uvula to the posterior wall was obvious, but the lateral wall movement could not be observed clearly (See Fig. 5).

DISCUSSION

Both phoneticians and otorhinolaryngologists have a great interest in velopharyngeal functions and this interest has resulted in various kinds of examinations. Among them, cinefluorographic studies have been utilized in many institutes and remarkable results have been reported (2, 3). With this

technique, velopharyngeal movement can be observed laterally and velor height, velumpharynx distance or other measurements can be obtained from film analysis.

Endoscopic procedures have been used by some investigators, but most reports concerned observations of patients with velopharyngeal abnormalities (4).

In this paper, the authors discuss normal velopharyngeal movements as a control study. In the examination, wide variations were observed not only among the resting forms of the horizontal section of the velopharyngeal cavities but also among the manner and forms of velopharyngeal closures. Sectional forms of velopharyngeal cavities were grouped into three resting forms: the "oblate elliptical type", "prolate elliptical type" and "intermediate type". The authors provided three types of closure forms: the "soft palate type", "lateral wall type" and "mixed type". There seemed to be some correlation between the resting forms and the closure forms, i.e. "soft palate types" were more often seen in "prolate elliptical types", while most "lateral wall types" were observed in "oblate elliptical types". However, there were many combinations of resting forms and closure forms and wide variations were observed in velopharyngeal movement.

In some subjects, movement of the posterior wall was observed. The movement was not independent of soft palate and/or lateral wall movement, and it seemed subordinant to the main movement. The protruding posterior wall seemed to play a part in the velopharyngeal closure, but only a minor part. The protruding movement was assumed to be the same phenomenon as Passavant's pad (1).

Velopharyngeal movement is usually observed by laryngoscopy from the oral cavity, and the gag reflex is usually used to induce velopharyngeal closure. This procedure is widely used because of its simplicity, but the observation of lateral wall movement and velor movement in close consonants is difficult. Halation often disturbs the observation in the fiberscopic and video tape recording procedure which is also used in such studies although halation is rare in our fiberscopic and cine camera method. In conclusion, our procedure has two advantages with respect to the observation of various velopharyngeal movements and halation-free observations.

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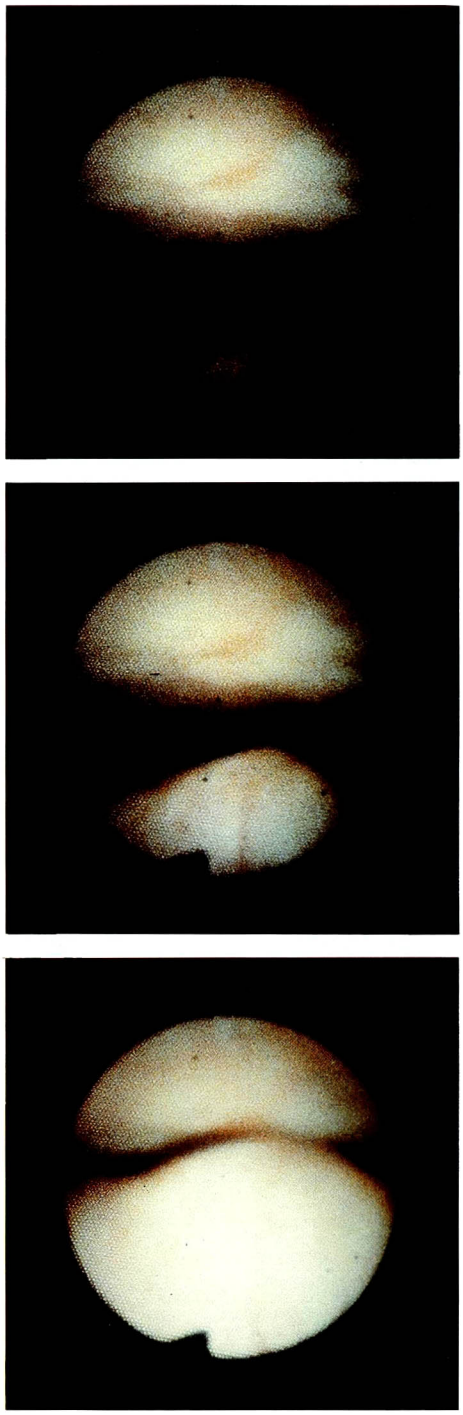

Fig. 2 Cine pictures of the "soft palate type" Velopharyngeal closure was chiefly obtained by movement of the soft palate.
(upper: picture at rest, middle: picture during closing movement, lower: picture in finished state)

Fig. 3 Cine pictures of the "lateral wall type"
Closure was obtained both by approaching movement of lateral walls and by movement of the soft palate.
(upper: picture at rest, middle: picture during closing movement, lower: picture in finished state)

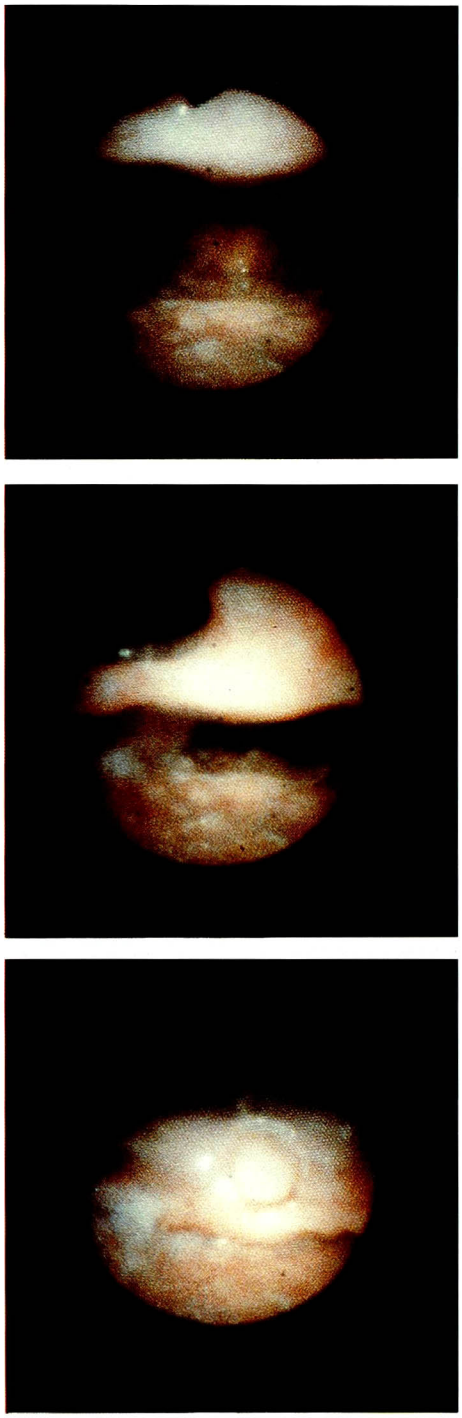

Fig. 5 Retrograde observation of velopharyngeal closure
Movement of the uvula was obvious but movement of the lateral wall was not clearly observed.
(upper: picture at rest, middle: picture during closing, lower: picture in finished state)